Diabetes insipidus in the dog and cat: a bibliographic review

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Background

Arginine vasopressin (AVP) is the main responsible for water homeostasis. AVP deficiency or its inability to interact normally with renal V_2 receptors results in diabetes insipidus (DI). The result of either disorder is severe hypotonic polyuria (PU) with compensatory polydipsia (PD). Central diabetes insipidus (CDI) is a complete or partial lack of AVP production. Nephrogenic diabetes insipidus (NDI) is a complete or partial lack of response to AVP. While primary NDI is extremely rare, secondary NDI is the most common cause of PU/PD in small animals. Several causes may decrease the responsiveness of renal tubules to AVP (Box 1). The definitive diagnosis of CDI, primary NDI and psychogenic polydipsia (PP) should be based on results of the modified water deprivation test (MWDT) (Fig. 1) and/or response to synthetic vasopressin (DDAVP) therapy, which results can be interpreted only after the causes of secondary NDI have been ruled out after following an appropriate diagnostic approach to PU/PD (Fig. 2).

Objectives

- To update the basic data about water balance physiology
- To define an updated differential diagnosis for PU/PD
- To update the diagnostic approach to DI
- To update the available information about the syndrome of inappropriate secretion of antidiuretic hormone (SIADH)

Box 1. Causes of polyuria and polydipsia in dogs and cats (Shiel 2017)

Central diabetes insipidus
Primary nephrogenic diabetes insipidus
Secondary nephrogenic diabetes insipidus
- Hyperadrenocorticism
- Hypodrenocorticism
- Hyperthyroidism
- Hyperaldosteronism
- Hepatic insufficiency
- Portosystemic shunt
- Pyelonephritis
- Pyometra/*Escherichia coli* endotoxemia
- Hypokalemia
- Hypercalcemia
- Erythrocytosis
- Leptospirosis
- Acromegaly
- Leiomyosarcoma
- Drug administration, e.g., glucocorticoids

Osmotic
- Diabetes mellitus
- Chronic kidney disease
- Primary renal glycosuria
- Fanconi syndrome
- Post-obstructive diuresis
- Drug administration, e.g., osmotic diuretics
- High salt diet

Low renal medullary tonicity
- Renal medullary washout
- Low protein diet

Other/Unknown
- Polyuric phase of acute kidney injury
- Splenic hemangiosarcoma
- Pheochromocytoma
- Syndrome of inappropriate antidiuretic hormone secretion

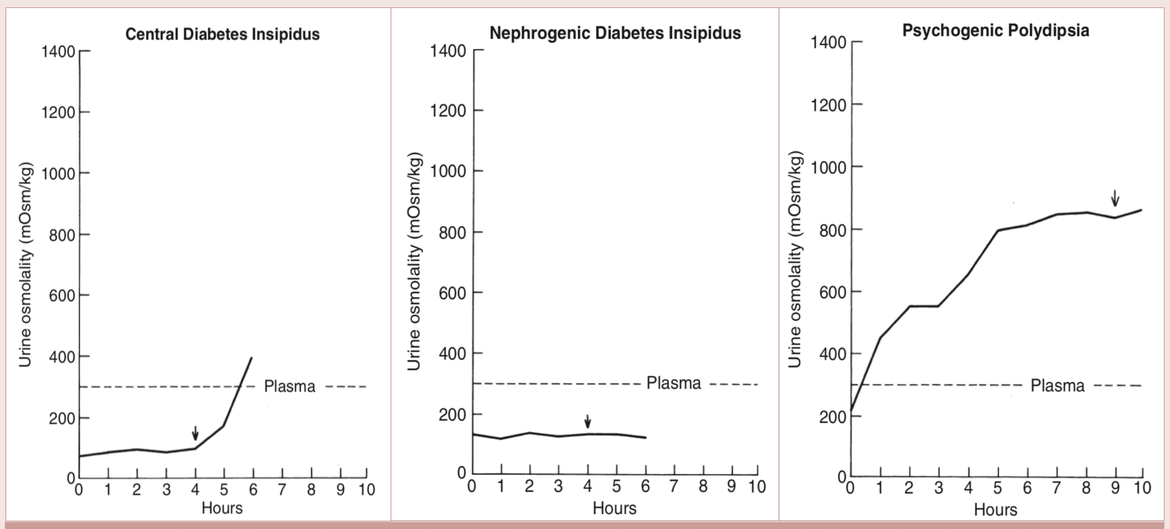

Figure 1. The effect of water deprivation on the urine osmolality of a dog with central diabetes insipidus (CDI, left), primary nephrogenic diabetes insipidus (NDI, middle), and psychogenic polydipsia (right, PP). ↓ represents an injection of aqueous vasopressin (DDAVP) administered after 5% or more body weight is lost (Nelson 2015).

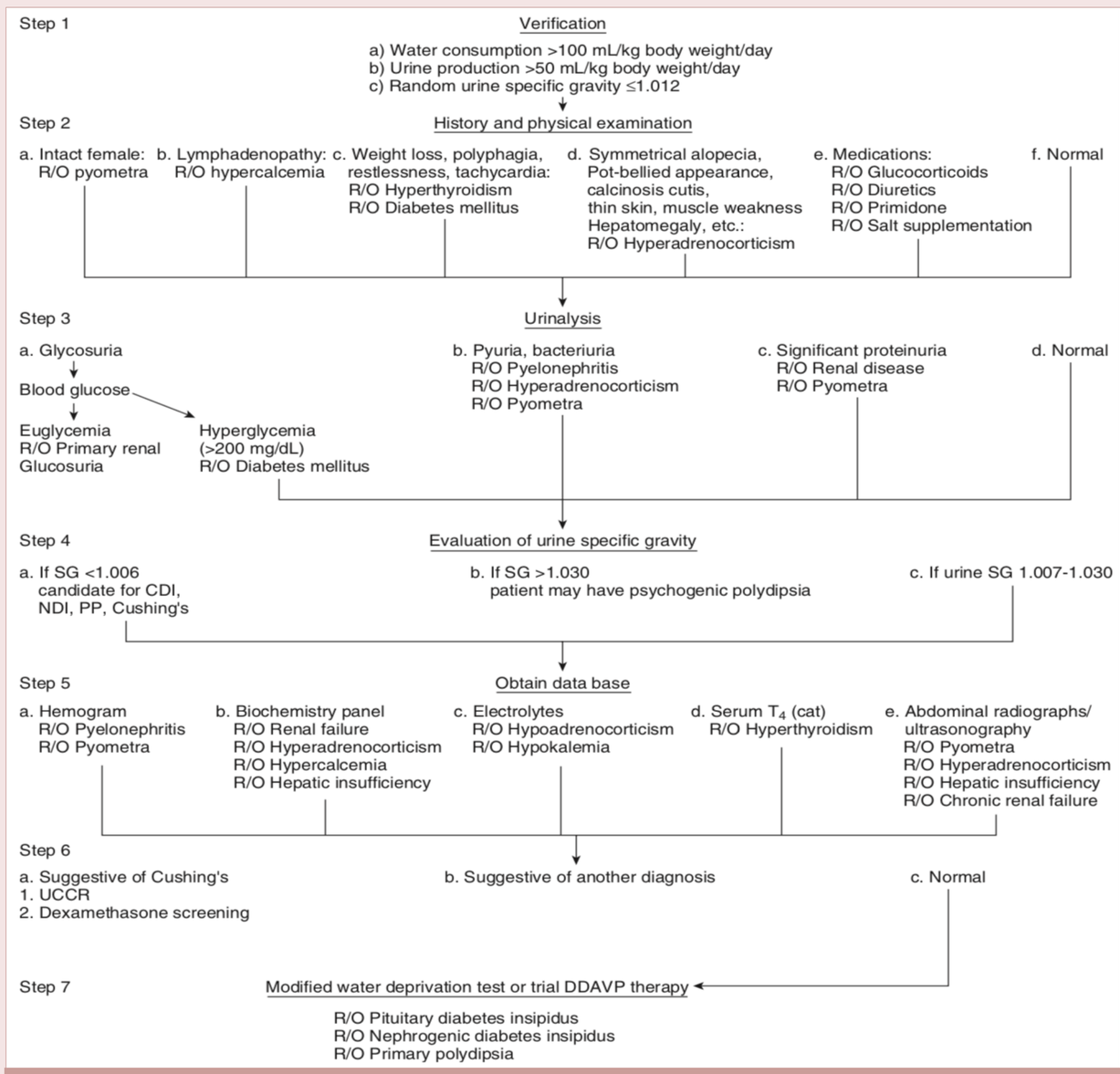

Figure 2. The diagnostic plan in a dog or cat with severe polyuria and polydipsia. *CDI*, Central diabetes insipidus; *DDAVP*, desmopressin acetate; *NDI*, nephrogenic diabetes insipidus; *PP*, primary (psychogenic) polidipsia; *R/O*, rule out (a diagnosis); *SG*, specific gravity; T_4, thyroxine; *UCCR*, urinary cortisol creatinine ratio (Nelson 2015).

Conclusions

- Pre-pro-vasopressin is comprised of the signal peptide and the polypeptides that later form the AVP, neurophysin-2 and copeptin, which function is unknown.
- Splenic hemangiosarcoma, canine hyperaldosteronism and SIADH must be included in the differential diagnosis of PU/PD.
- The MWDT has associated risks for the patient and must be carried out only when previous protocol has been completed.
- The definitive diagnosis of CDI remains a challenge, and copeptin measurement could be a diagnostic tool in the future.
- True SIADH incidence may be more common than DI.

References

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Shiel RE. 2017. Polyuria and polydipsia. In: Ettinger SJ, Feldman EC, Côté E, editors. Textbook of veterinary internal medicine: diseases of the dog and the cat. 8th ed. St. Louis: Elsevier. p. 660-665.